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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/731,647

12/09/2003

Antonio L.P. Rotondaro

TI-35226

5024

23494

7590

10/01/2004

TEXAS INSTRUMENTS INCORPORATED

P O BOX 655474, M/S 3999

DALLAS, TX 75265

EXAMINER

THOMAS, TONIAE M

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 10/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/731,647

Applicant(s)

ROTONDARO ET AL.

Examiner

Toniae M. Thomas

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/09/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

1. This action is a first Office action on the merits of Application Serial No. 10/731,647. Currently, claims 1-21 are pending.

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. *Claims 1, 10, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Ma et al. (US 6,060,755).*

The Ma et al. reference (Ma) discloses a method for annealing a high dielectric constant (high-k) gate dielectric layer (fig. 14; col. 1, lines 8-12; and col. 6, lines 7-65). The method comprises: placing a wafer including one or more partially formed transistors in an ambient comprising a forming gas (N<sub>2</sub>:H<sub>2</sub>) and an oxidizer, respective transistors comprising a high-k gate dielectric layer formed over a substrate (col. 6, lines 13-26); and heating the high-k gate dielectric layer to a temperature greater than 700 degrees Celsius while the gate dielectric layer is in the ambient, the ambient mitigating the formation of lower dielectric constant (lower-k) material between the high-k gate dielectric layer and the substrate (col. 6, lines 13-26).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. *Claims 2-9, 11-15, and 17-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. in view of Park (2001/0006843 A1).*

Claims 3, 5, 7, 9, 12, 14, 18, and 20 are unpatentable over Ma as applied above (see col. 6, lines 13-26 and col. 6, lines 55-61). Regarding claim 7, the likelihood of crystallization of the high-k material is mitigated (col. 3, lines 53-61).

As stated above Ma discloses heating the high-k material in an ambient comprising a forming gas (N<sub>2</sub>:H<sub>2</sub>) and an oxidizer. Whereas Ma discloses heating in an ambient comprising a forming gas (N<sub>2</sub>:H<sub>2</sub>) and an oxidizer, Ma lacks anticipation in not teaching that the ambient comprises ammonia (NH<sub>3</sub>), as recited in claims 2, 11, and 17. The Park pre-grant published application (Park) discloses a method for forming a gate dielectric layer over a substrate (figs. 1-5 and accompanying text). The method comprises performing a heat treatment in an ambient comprising either NH<sub>3</sub> or N<sub>2</sub>:H<sub>2</sub> (par. 27, lines 1-5). Park suggests that NH<sub>3</sub> and N<sub>2</sub>:H<sub>2</sub> are art-recognized equivalents.

Since Ma and Park are from the same field of endeavor, the purpose for which Park is relied upon would have been recognized in the pertinent reference of Ma by one of ordinary skill in the art at the time the invention was made.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify Ma in view of Park by substituting the forming gas  $N_2:H_2$  with  $NH_3$ , as taught by Park, since the forming gas  $N_2:H_2$  and  $NH_3$  are art-recognized equivalents.

Ma does not teach that a greater concentration of the oxidizer is included in the ambient when nitrogen is pre-existing within the high-k material, as recited in claim 8. However, controlling the oxidizer in the ambient to obtain the desired result is well within ordinary skill. Thus, claim 8 is taken to be obvious over the combination of Ma and Park.

Ma does not teach maintaining the high-k dielectric layer and ambient under a pressure of about 200 Torr, as recited in claims 4, 13, and 19; or maintaining the high-k dielectric layer and ambient under a pressure of about 20 Torr, as recited in claims 6, 15, and 21. However, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to maintain the high-k dielectric layer and ambient under the claimed pressure, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art (*In re Boesch*, 617 F.2d, 272, 205 USPQ 215 (CCPA 1980)).


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday-Thursday from 8:30 a.m. to 5:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*JMJ*

27 September 2004

  
AMIR ZARABIAN  
ASSISTANT PATENT EXAMINER  
EBC CENTER 2800